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A REVISION OF PHACELIA SECTION MILTITZIA

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INTRODUCTION

THE SPECIES which are here presented as the section *Miltitzia* of the genus *Phacelia* have formerly been treated either as constituting the genus *Miltitzia* A. DC. or as forming the more numerous part of the genus *Emmenanthe* Benth. (*Emmenanthe* § *Miltitzia* A. Gray). I have recently expressed my belief that there is definitely a generic break between *Miltitzia* and *Emmenanthe* but that *Miltitzia* exhibits both morphologically and habitually a relationship so close to *Phacelia* sect. *Microgenetes* that it should be treated as a section in *Phacelia* (1944, pp. 12-16). The plump, corrugated seeds found in sect. *Miltitzia* are like those in sect. *Microgenetes*, while the compressed, reticulate seeds of *Emmenanthe* are different from any in *Phacelia*. Moreover the lateral attachment of the ovules to fleshy placentae in *Miltitzia* is characteristic of *Phacelia*, while in *Emmenanthe* the pendent ovules are basally attached to the wing-like margins of membranous placentae. The marcescent persistent corolla, by which the species of sect. *Miltitzia* may be distinguished from those of sect. *Microgenetes*, was the character by which *Miltitzia* was separated from *Phacelia* although the character was not finally diagnostic since several species in *Phacelia* sect. *Eutoca* also have persistent corollas. Although it is this corolla character which *Miltitzia* and *Emmenanthe* have in common, all other structural characters of *Miltitzia* are entirely *Phacelia*-like and indicate a relationship to *Phacelia* that must be interpreted as sectional rather than generic.

The section *Miltitzia* consists of only nine species and these are confined to the desert areas of the western United States between the Rocky Mountains



on the east and the Sierra Nevada and Cascade Range on the west, extending northward to latitude 45° N. or thereabouts and southward to about 35° N. In this relatively limited area, the northern part of Nevada is not only the geographic center for the distribution of the species, but is also the center for species concentration. Here are found seven of the nine species, while in adjacent southeastern Oregon are five and in eastern California four. To the eastward not more than two species are found in any one state. Three of the nine species are relatively common and widespread, *P. adenophora*, *P. scopulina*, and *P. tetramera*; two are more localized in distribution and less common, *P. inundata* and *P. lutea*; four are to be counted among the rarest of western plants: *P. glaberrima*, known only from three collections; *P. inyoensis* and *P. submutica* known from a few collections from restricted areas; and *P. salina*, known from five stations in three different states.

Even to the present, there has been considerable confusion and not a little difficulty in limiting species, part of this being due without doubt to the meagerness of collections available for study. A critical examination of numerous specimens assembled from various collections and institutions has revealed a series of mostly clear-cut and readily defined entities. Habit, foliage, and vesture have been found quite variable within species so that plants unlike in aspect are sometimes referable to the same species because of the critical but dependable characters in flowers and fruits. Because so little is known about the field occurrence of the subspecific variants, only a single variety has been recognized taxonomically, but undoubtedly others will be recognized as the variants become better known. *Phacelia adenophora*, *P. lutea*, and *P. scopulina* are the only species presenting facies so polymorphic that they may be sometimes confused with related species. The first, which may be considered the most primitive species in the group because of its larger flower-parts and hairy corolla-tube and filaments, is sometimes difficult to distinguish from *P. lutea* and *P. inundata*. *Phacelia scopulina*, the most widely distributed species in the section, is also the most variable; to the west there are intergrades with *P. lutea*, in the southeast *P. submutica* is very closely related, and *P. salina* seems to be merely an ecologically specialized variant with smaller parts.

From a consideration of the environments in which these phacelias are found, it is very apparent that speciation in the group has produced entities which occupy several of the most highly specialized situations in our western deserts. Thus *P. inundata* is nearly confined to playas of evanescent ponds and shrunken lakes. *Phacelia tetramera* and *P. salina* are commonly restricted to highly saline flats. Although *P. scopulina* is generally rather common in sandy or gravelly soil of juniper slopes or sagebrush flats, it, too, sometimes occurs locally in more alkaline situations. *Phacelia adenophora* grows on sagebrush slopes, but in certain forms it is characteristic of clay flats of high plains. The closely related *P. lutea* seems to be characteristic of wash slopes of clay hills and valleys of eastern Oregon; and the highly localized *P. inyoensis* seems to be confined to boggy spots among granitic sands bordering the

western Sierra. In no other group of like size in the genus are there so many forms edaphically specialized and localized, rare creations to thrill the soul of the botanical traveler who might chance upon one flourishing amid the vast loneliness and seeming desolate sterility of a saline desert.

ACKNOWLEDGMENTS

This revision has been prepared in the Herbarium of the California Academy of Sciences (CAS), and, although the collection there has furnished the basis for research, my study would have been far from complete if I had not been able to borrow abundant collections from other institutions. These institutions are here listed, together with the symbol used in citing specimens:

- Chicago Natural History Museum (CM)
- Dudley Herbarium, Stanford University (DS)
- Gray Herbarium, Harvard University (G)
- Intermountain Herbarium, Utah State Agricultural College (IU)
- Missouri Botanical Garden (M)
- Greene Herbarium, University of Notre Dame (ND)
- New York Botanical Garden (NY)
- Pomona College (P)
- Rocky Mountain Herbarium, University of Wyoming (RM)
- University of California (UC)
- United States National Herbarium (US)
- Willamette University (W)
- Washington State College (WS)

For the privilege of borrowing specimens, I am very grateful; and again I wish to express my gratitude and appreciation to many friends who have furnished me with field data and specimens in this group over a period of years. Especially am I grateful to H. D. Ripley and R. C. Barneby for a complete set of their numerous excellent collections which they have obtained during the course of their critical field work in western American deserts from 1940 to 1944. The number of specimens cited from their collections in the present revision is indicative of the important contribution they have made to my study.

Also it should be noted that because type specimens in the United States National Herbarium and in the Herbarium of the New York Botanical Garden are not available for study during wartime, some collections that are undoubtedly in those institutions are not cited in this paper.

TAXONOMY

PHACELIA sect. MILTITZIA (A. DC.) J. T. Howell, Leaf. West. Bot. 4: 15 (1944). *Miltitzia* A. DC. in DC. Prodr. 9: 296 (1845). *Emmenanthe* § *Miltitzia* (A. DC.) A. Gray, Proc. Amer. Acad. 10: 328 (1875).

Flowers 5-merous or occasionally 4-merous; corolla marcescent, yellow or frequently tinged with lavender or violet; corolla-scales present or lacking; filaments glabrous except in one species; ovary generally more or less pubes-

cent, the style pubescent at least at base except in one species, ovules 4–26, laterally attached to fleshy placentae; capsule apiculate or mucous; seeds transversely corrugated.—Annual herbs of saline or subsaline habitats in western North American deserts; herbage frequently fleshy, more or less pubescent and glandular, occasionally glabrous; stems branching and generally widely spreading; leaves entire to deeply pinnately divided.

KEY TO THE SPECIES

- A. Corolla-tube hairy inside between stamens; filaments hairy. 1. *P. adenophora*
 A. Corolla-tube glabrous inside; filaments glabrous.
 B. Seeds faintly but definitely transversely striate, the striations about 12; ovules 20–26. 3. *P. inundata*
 B. Seeds prominently transversely corrugated, the corrugations 6–12; ovules 4–20.
 C. Corolla 5–8 mm. long; corolla-scales generally conspicuous and united to base of filaments about 0.5 mm.; style and branches (1.75 or) 2–3.75 mm. long; hypogynous disk conspicuous with prominent rounded or deltoid lobes alternating with the stamens. 2. *P. lutea*
 C. Corolla 1.3–4.5 mm. long; corolla-scales inconspicuous, obsolescent, or lacking, free from the filaments at base if present; style and branches 0.25–2 mm. long.
 D. Plants glabrous or nearly so; corolla subtotate in anthesis, the lobes often about as long as the tube; ovary and style glabrous or nearly so. 4. *P. glaberrima*
 D. Plants more or less hirsutulous or villous and capitate-glandular or viscidulous; corolla campanulate, the lobes shorter than the tube (or about equaling the tube in *P. tetramera*); ovary generally sparsely to densely hairy, the style hairy at least at base.
 E. Flowers mostly 5-merous; corolla 3–4.5 mm. long.
 F. Style and branches 1.25–2 mm. long; hypogynous disk inconspicuous; ovules 10–15. 5. *P. scopulina*
 G. Style hairy to above middle; capsule apiculate. 6. *P. submutica*
 F. Style and branches 1 mm. long; hypogynous disk relatively conspicuous.
 H. Ovules 18–20; seeds nearly 1 mm. long, the corrugations 6 or 7 7. *P. inyoensis*
 II. Ovules 7–9; seeds 1.5–2 long, the corrugations about 9–11. 8. *P. salina*
 E. Flowers commonly 4-merous; corolla 1.3–1.8 mm. long. 9. *P. tetramera*

1. *Phacelia adenophora* J. T. Howell

Leaf. West. Bot. 4:15 (1944)

Emmenanthe glandulifera Torr. ex S. Wats., Bot. U.S. Geol. Explor. 40th Paral. (King's Exped.) 257 (1871).

Miltitzia glandulifera (Torr.) Heller, Mühlenbergia 8:20 (1912).

Miltitzia glandulifera (Torr.) Heller var. *californica* Brand, Univ. Calif. Publ. Bot. 4:224 (1912).

Not *Phacelia glandulifera* Piper, Contrib. U.S. Nat. Herb. 11:472 (1906).

Stems few or several, spreading from the top of the annual taproot, prostrate or strongly ascending, slender or rather stout, mostly 1–3 dm. long, capitate-glandular and villous-puberulent or hirsutulous; basal leaves not very numerous and the upper leaves rather sparse, to 3 cm. long and 1.7 cm. wide, oblongish to subovate, pinnately lobed or divided, the lobes oblongish, obtuse, entire or rarely dentate-lobed, the uppermost leaves sometimes entire, hirsutulous and little glandular, petioles hirsutulous and glandular, to 2.5 cm. long; racemes mostly exceeding the leafy part of the plant, to 1 dm. long, sessile or nearly so, flowers somewhat distant below, congested above or the flowers on spreading or recurved pedicels, pedicels stout or slender, 1–3 mm. long; flowers 5-merous; calyx-segments in flower 2–4.5 mm. long, 0.4–1 mm. wide, in fruit 5–6.5 mm. long, 0.5–1.25 mm. wide, linear to narrowly oblong-oblancheolate, sometimes a little spatulate, obtuse, hirsutulous and more or less glandular; corolla marcescent and a little accrescent, tubular to campanulate, yellow or the lobes more or less tinged with lavender, 4–7 mm. long, lobes 1.25–2 mm. long, outside of corolla hairy, inside sparsely to densely hairy in the tube between the stamens; corolla-scales 1–2 mm. long, linear to narrowly semilinear-lanceolate, attached at base to base of filaments about 0.5 mm.; stamens 3–5 mm. long, somewhat unequal, the filaments hairy below the middle, anthers 0.5–0.75 mm. long (or rarely shorter); styles and branches 2–4 mm. long, the style hairy to the middle, branches 0.5–0.75 mm. long; ovary 1 mm. long, ovules 8–14; hypogynous disk relatively prominent, the lobes between the stamens broad and rounded; capsule 4–6 mm. long, oblong to oblong-ovate, subacute to truncate below the terminal apiculation, longitudinally sulcate on backs of valves, sparsely puberulent, sometimes a little glandular above; seeds oblongish, 1–1.5 mm. long, black-brown, prominently transversely corrugated, corrugations 8–12, rounded and mostly broad.

Alkaline soil of high plains and sagebrush slopes, from middle western Nevada northward to northeastern California and southeastern Oregon.

Representative collections. NEVADA: Virginia Mts., 5000 ft., *S. Watson No. 885* (G, type collection of *Emmenanthe glandulifera*); about 6 miles south of Gardnerville, Douglas Co., *Cantelow in 1941* (CAS, CM, IU, US); Carson City, Ormsby Co., *Anderson in 1865* (G, NY); Reno, Washoe Co., *M. E. Jones No. 3986* (CAS, DS, G, IU, M, NY, P, RM, US), *Eastwood No. 14773* (CAS, CM, P); 5 miles east of Sparks, Washoe Co., *Eastwood and Howell No. 30* (CAS, US); Pyramid Lake, Washoe Co., *Kennedy No. 1037* (CM, DS, G, M, NY, RM, UC, US); 12 miles north of Reno toward Pyramid Lake, Washoe Co., *Ripley and Barneby No. 4491* (CAS, G). In Gray Herbarium is a specimen labeled "Winnemucca Valley" collected by Lemmon in 1875, but the correctness of the locality is to be questioned.

CALIFORNIA: Near Viewland, Lassen Co., *Ripley and Barneby No. 5755* (CAS); 12 miles north of Susanville, Lassen Co., *J. T. Howell No. 11884* (corolla-limb pale lavender fading to lavender-rose; CAS, US, W, WS); Horse Lake, Lassen Co., *J. T. Howell No. 11892* (corolla bright yellow; CAS,

CM, G, IU, M, ND), *J. T. Howell No. 11898* (corolla-limb lavender; CAS, NY, P, RM); Madeline Plains, Lassen Co., *Bruce No. 2135* (UC, type of *Miltitzia glandulifera* var. *californica*), *Peirson No. 6851* (CAS, P), *J. T. Howell No. 11909A* (CAS, DS, W); canyon below Jess Valley, Modoc Co., *Payne No. 549* (CAS).

OREGON, Harney Co.: Catlow Valley, *Henderson No. 8690* (CAS); Blitzen, *Train No. 90* (US); base of Steens Mts., *Train* (Univ. Colo.). These collections from Oregon are not typical and show characters that vary toward *P. lutea*.

Phacelia adenophora is a rather variable entity, but it is usually well marked by the conspicuous pubescence on the filaments and in the corolla-tube. In typical form as it occurs in middle western Nevada, it is a slender and somewhat elegantly branched plant with the upper parts rather finely hirsutulous and copiously capitate-glandular. In the vicinity of Reno, Nevada, and to the northward, this typical variant passes by numerous intergrades into a coarser, more densely pubescent plant with flowers a little larger, the form which Brand called *Miltitzia glandulifera* var. *californica*. From southeastern Oregon relatively few collections of *P. adenophora* are known, but, because the plants that grow there frequently exhibit characters intermediate to *P. lutea* which also grows in the same region, it is suspected that the intermediates may be of hybrid origin.

Although *P. adenophora* is closely related to *P. lutea* and perhaps should be considered only a variety of that species, I regard the differences between the two specific in value. It is true that Asa Gray remarked that *P. adenophora* (*Emmenanthe glandulifera*) was "probably a mere form" of *P. lutea* (1878, p. 171), but an examination of specimens in Gray Herbarium discloses that at that time he had no specimen of *P. lutea*, and that he mistook for that species the more robust form of *P. adenophora* which Brand has called *Miltitzia glandulifera* var. *californica*. Quite recently Jepson has treated *P. adenophora* and *P. lutea* as the same species (1943, p. 281, as *Miltitzia lutea*), but each is characterized by a distinctive appearance and each by its own peculiar set of variations which do not approach each other except in instances of suspected hybridization. I do not believe that there should be a change in the status of *P. adenophora* until its relation to *P. lutea* is clearly understood through more detailed study and critical field work.

Within *P. adenophora* no variant seems sufficiently distinguished to be recognized taxonomically. Although Brand's var. *californica* of northeastern California has considerable right to varietal recognition, I have concluded that it is not clearly enough defined either geographically or morphologically to be accepted at this time. Also I have seen several collections of a peculiar glandular-villous form with large flowers and slender fruits from southern Oregon which should perhaps be accorded taxonomic recognition, but, because of a possible connection which this plant may have with the imperfectly understood relations between *P. adenophora* and *P. lutea* in that region,

nominal recognition of this entity, too, should await more numerous collections and further field work.

A collection intermediate between *P. adenophora* and *P. lutea* is *Coville and Leiberg No. 68* (US), from the road to Coleman Valley, Harney or Malheur Co., Oregon. In it the corolla-tube is pubescent only at the base of the stamens, or glabrous, and the filaments vary from subglabrous to distinctly hairy. Another intermediate collection from Oregon looking quite like *P. adenophora*, but with the technical floral characters of *P. lutea*, is *Willits No. 169* (DS) from Hart Lake, Lake Co. A collection of *P. adenophora* which resembles *P. lutea*, but which has heavily hairy corolla-tube and filaments, has been collected near Canby, Modoc Co., California, *J. T. Howell No. 12215* (CAS).

2. *Phacelia lutea* (H. and A.) J. T. Howell

Leaf. West. Bot. 4:15 (1944)

Stems one to several from the top of an annual taproot, spreading or ascending to substrictly erect, 2–8 cm. long, hirsutulous and scarcely glandular to hirsutulous and capitate-glandular or almost entirely glandular-villous; leaves entire or coarsely serrate, rarely serrate-lobed, oblanceolate and oblong to elliptic and ovate, mostly 1–2.5 cm. long, 0.3–1 cm. wide, hirsutulous and a little glandular to sparsely glandular-villous, obtuse at apex, cuneate at base, petiole to 2.5 cm. long, usually equaling or shorter than the blade; racemes to 5 cm. long, sometimes more or less exceeded by and concealed by the leaves but generally exceeding the leaves and showy, pedicels 1–2 mm. long or the lowest to 5 mm. long, the lowest sometimes reflexed in fruit; calyx-segments in flower 3.5–5 mm. long, in fruit 6.5–9 mm. long, 1–1.75 mm. wide, linear-oblong to narrowly oblong-oblanceolate, subacute, hirsutulous and more or less glandular to rather densely capitate-glandular; corolla yellow, sometimes becoming lavender-tinged in age, 5–8 mm. long, campanulate or tubular, the lobes erect or spreading in anthesis, 1–2 mm. long, denticulate, corolla sparsely hairy outside, glabrous inside; corolla-scales 2–3 mm. long or sometimes obsolescent, semilinear-lanceolate, attached at base about 0.5 mm. to the filaments; stamens 3–5.5 mm. long, filaments glabrous, anthers 0.4–0.75 mm. long; style and branches 1.75–3.75 mm. long, branches 0.25–0.75 mm. long, style hairy only near the base or to above the middle; ovary 1.25–1.75 mm. long, ovules 10–17; hypogynous disk prominent with conspicuous rounded or deltoid lobes between the stamens; capsule 5.5–7 mm. long, oblong to elliptic, subobtuse, apiculate, the beak to 1 mm. long, sparsely hairy and a little glandular; seeds 1–1.5 mm. long, elliptic-oblong, subobtuse to subacute, brown, prominently corrugated, the corrugations about 9 or 10, conspicuously reticulate.

Clayey and sandy slopes and flats in southeastern Oregon, occurring locally in western Idaho and northwestern Nevada.

The type of *P. lutea* was part of a collection of plants "gathered in the summer of 1837 by a friend of Mr. Tolmie" at "Snake Fort, Snake Country." In

the introduction to the Supplement of Botany of Captain Beechey's Voyage (p. 315), it is stated that "Snake Fort is built at the junction of Reed's River with the Snake [River], the position of which is in N. lat. $44^{\circ} 20'$, long. $116^{\circ} W$." On modern maps the name Reed's River does not appear and the latitude and longitude indicate a point considerably east of the Snake River. On the map in Hooker's *Flora Boreali-Americana*, vol. 1, however, Reed's River is given and from its position it is clearly the Boise River of the present day, the chief affluent of the Snake River from the east between the Payette River and the great bend of the Snake. Hence, collections that have been available from northwestern Owyhee County, Idaho, may be regarded as topotypes of this interesting species that was first collected more than a hundred years ago.

As has been pointed out in the discussion of *P. adenophora*, Asa Gray had no specimens of *P. lutea* at the time he prepared his account of *Emmenanthe* § *Miltitzia* for the Synoptical Flora (1878). As is indicated by his annotations on specimens in Gray Herbarium, he did receive collections of *P. lutea* from Cusick by the time the second edition was published (1886), but there is nothing in the supplement of the second edition concerning these specimens. Cusick's plants, collected from three different stations under varying environments, were probably more confusing than helpful to Gray. One part of the collection, No. 1233a, from "sandy hillsides of Malheur and vicinity" is typical *P. lutea*, but No. 1233b, "same locality but on heavy clay soil," and No. 1233c, "barren valley in rather heavy soil," are quite different in appearance and were originally noted as probably *Emmenanthe parviflora* (*P. inundata*) by Gray, and were more recently identified as *Miltitzia glandulifera* (i.e., *P. adenophora*) by Macbride. Although these puzzling plants and others like them from Professor Peck's collections are definitely referable to *P. lutea*, they vary toward *P. scopulina* and present a problem of relationship that can only be indicated at this time. These variants are discussed further under *P. scopulina*, and under *P. adenophora* the problem of intermediates between that species and *P. lutea* is discussed.

One variant in *P. lutea*, however, seems quite distinct and well deserving taxonomic recognition, a small-flowered plant with glandular-villous pubescence. This variety may be distinguished as follows:

KEY TO VARIETIES OF *Phacelia lutea*

Corolla 6-8 mm. long; style hairy to the middle or above var. *typica*
 Corolla 5-6 mm. long; style hairy only near the base var. *purpurascens*

2a. *Phacelia lutea* (H. and A.) J. T. Howell var. *typica*, nom. nov.

P. lutea (H. and A.) J. T. Howell, l. c.

Eutoca lutea H. and A. Bot. Beech. Voy. 373 (1840); Hook. Icon. tab. 354 (1841).

Miltitzia lutea (H. and A.) A. DC. in DC. Prodr. 9:296 (1845).

Emmenanthe lutea (H. and A.) A. Gray, Proc. Amer. Acad. 10:328 (1875).

Plants hirsutulous and scarcely glandular to moderately glandular-hirsutulous, generally yellowish-green; racemes mostly exceeding the leaves; corolla 6–8 mm. long, showy; style sparsely hairy to the middle or above, 2.5–3.75 mm. long.

Representative collections. IDAHO: Squaw Creek near Marsing, Owyhee Co., *Tucker No. 1029* (CAS ex Univ. Ida. So. Br.).

OREGON: Harper, Malheur Co., *Peck No. 20553* (CAS, W), *Henderson No. 8689* (CAS); 5 miles south of Harper, Malheur Co., *Peck No. 16104* (W, approaching var. *purpurascens*); Rockville, Malheur Co., *Henderson No. 8691* (CAS, depauperate); Sucker Creek, 30 miles north of Jordan Valley, Malheur Co., *Holmgren No. 2206* (CAS, IU); Malheur Butte, Malheur Co., *Leiberg No. 2043* (CM, G, NY, UC, US); 15 miles southeast of Blitzen, Harney Co., *Applegate No. 5591* (DS, W); near Burns, Harney Co., *Lilla Luch in 1927* (W); base of Steens Mts., Harney Co., *Howell in 1885* (CM, G, NY, US); Unity, Baker Co., *Peck No. 16186* (W); Paulina Creek northeast of Lapine, Deschutes Co., *Whited No. 1679* (ND).

NEVADA: Virgin Valley, Humboldt Co., *L. Kellogg in 1909* (P).

An unusual variant, entirely glabrous except for an occasional hair in the inflorescence and for a few scattered hairs and glands at the top of the ovary and on the lower part of the style, has been collected by Ripley and Barneby in Owyhee County, Idaho, where it grew on a "friable alkaline clay bank 24 miles southwest of Marsing" (*No. 6153*, CAS, G, US). A few of the corollas were noted by the collectors as being tetramerous.

2b. *Phacelia lutea* (H. and A.) J. T. Howell

var. *purpurascens* J. T. Howell, var. nov.

Glanduloso-villosa vix hirsutula, caulibus foliis rhachidibus et segmentis calycis valde purpurascenti-tinctis; foliis racemos plerumque superantibus; corolla 5–6 mm. longa; stylo 1.75–2.5 mm. longo, pilifero solum prope basin.

Type: Herb. Calif. Acad. Sci. No. 127399, collected in "chocolate soil" on high hills opposite **Humphrey's, Grant County, Oregon**, by L. F. Henderson, *No. 5092*, April 30, 1925. There is a duplicate in Gray Herbarium. Only one other collection entirely typical of var. *purpurascens* has been seen: *Cusick No. 2634*, which was obtained "in red clay soil of Crook Co." (CM, G, M, ND, NY, P, RM, UC, US).

3. *Phacelia inundata* J. T. Howell

Leaf. West. Bot. 4:15 (1944)

Emmenanthe parviflora A. Gray, U.S. Pacif. RR. Reports 6:84, tab. 15 (1857).

Miltitzia parviflora (A. Gray) Brand, Das Pflanzenr. IV. 251:131 (1913).

Not *Phacelia parviflora* Pursh, Fl. Amer. Sept. 1:140 (1814); nor *P. parviflora* Phil., Anal. Univ. Chile 90:226 (1895).

Stems several, spreading or ascending from the top of the annual taproot, mostly 1–4 dm. long, but the plants sometimes depauperate and the stems only 0.1–0.3 dm. long, finely glandular and somewhat hirsutulous; leaves rosu-

late and also rather numerous up to the ends of the branches, mostly 1–3 cm. long and 0.4–1.5 cm. wide, oblong to oblong-obovate, subentire to pinnately parted and divided, the divisions obtuse, mostly entire, oblong or deltoid-oblong, the terminal division largest and generally lobed, the basal divisions frequently small and discrete, petioles 0.5–2 cm. long, finely glandular-hirsutulous, the blades finely hirsutulous and a little glandular beneath; racemes mostly exceeded by the leaves, to 12 cm. long, the lowest flowers rather distant, the uppermost somewhat crowded, pedicels 1–2 mm. long or the lowest to 4 mm. long, erect or somewhat spreading in fruit; flowers 5-merous; calyx-segments in flower narrowly oblongish, 4 mm. long, 0.6–1 mm. wide, in fruit 6–10 mm. long, 1–1.5 mm. wide, linear-oblong to linear-oblong, sometimes a little spatulate, obtuse, hirsutulous and a little glandular; corolla yellow, 4–5 mm. long, the lobes rotately spreading in anthesis, becoming erect later, lobes about 2 mm. long, pilose-hairy outside, glabrous within; corolla-scales narrowly semilinear-lanceolate, 1.25 mm. long, at base free from filaments, or the scales obsolete; stamens quite unequal, 2–3 mm. long, filaments glabrous, anthers roundish, 0.3 mm. long; style and branches 1–1.25 mm. long, style hirsutulous nearly to the branches, branches 0.25 mm. long; ovary 1.5 mm. long, densely hirsutulous, ovules 20–26; hypogynous disk rather prominent with rounded lobes between the stamens; capsule 5.5–7 mm. long, oblong, abruptly narrowed above into a prominent deltoid apiculation and persistent style, sparsely hairy below, sparsely hirsutulous above and on the beak, not glandular; seeds 1.5–1.75 mm. long, subdeltoid, irregularly angled, mostly acute at the ends, tending to be strongly flattened, reticulate-pitted, finely but definitely transversely striate, the striations about 12–14.

Summer-dried playas of desert lakes and sinks from middle southern and southeastern Oregon south to northeastern California and middle western Nevada.

Collections. OREGON: Klamath Lake, Klamath Co., *Newberry* (G, type); Silver Lake, Harney Co., *Cusick No. 2727* (CM, G, M, ND, NY, P, RM, UC, US; plant noted as having a "very disagreeable odor"); Steens Mts. above Alberson, Harney Co., *Peck No. 14217* (NY, W).

CALIFORNIA: east side of Clear Lake, Modoc Co., *J. T. Howell No. 12357* (CAS, US); between Malin and Canby, Modoc Co., *M. S. Baker No. 8307* (CAS); west side of Eagle Lake at Spaldings, Lassen Co., *J. T. Howell No. 12510* (CAS, CM, DS, P, W).

NEVADA: Swan Lake, Washoe Co., *Train No. 3006* (IU, NY); Washoe Lake, Washoe Co., *M. E. Jones in 1897* (CAS, P); Franktown, Washoe Co., *Ripley and Barneby No. 5947* (CAS).

Phacelia inundata is one of the more rarely collected species in the section *Miltitzia*. Although three of the nine collections that have been examined have come from northeastern California, before this it has been reported only from southeastern Oregon and Nevada (Tidestrom, 1925, p. 448; Peck, 1941, p. 593). Only a single specimen has been seen (*Peck No. 14217*) in which the

collection data indicate an environment away from a desert lake or sink, while the Californian collections which I made came from lake-bottom areas that had been covered with water in the earlier part of the season. Because of its preference for so peculiar a habitat, *P. inundata* appears to be one of the most highly specialized and advanced species in the genus from a physiological point of view. Morphologically it is quite distinct, too, its nearest relative perhaps being *P. lutea*.

4. *Phacelia glaberrima* (Torr.) J. T. Howell

Leaf. West. Bot. 4:15 (1944)

Emmenanthe glaberrima Torr. ex S. Wats., Bot. U.S. Geol. Explor. 40th Paral. (King's Exped.) 257 (1871).

Militizia glaberrima (Torr.) Brand, Das Pflanzenr. IV. 251:131 (1913).

Stems several, spreading from top of annual taproot, 3-20 cm. long and probably longer, first internodes above the base very long, entirely glabrous; leaves 1-1.5 cm. long, 0.4-1 cm. wide, glabrous or with a few hirsutulous hairs on the margins and near the apex, broadly oblanceolate and ovate to broadly elliptic, entire or with 1 to few coarse serrations, obtuse at apex, narrowly cuneate at base and frequently a little decurrent along the petiole, petiole to 2 cm. long below, very short above; racemes to 8 cm. long, flowers approximate or rather distantly spaced, pedicels mostly 1-3 mm. long; flowers 5-merous; calyx-segments in flower very unequal, 2.5 mm. long, 0.25-1 mm. wide, in fruit 4-5 mm. long, 0.3-2 mm. wide, oblanceolate to obovate, fleshy and with a prominent midrib near the base, glabrous or with a few short scattered hirsutulous hairs near the apex; corolla 3-4 mm. long, subrotate in anthesis, the lobes 1-3 mm. long, becoming erect later, entirely glabrous within and without; corolla-scales obsolete; stamens 2.5-3 mm. long, filaments glabrous, flattened at base, anthers 0.4 mm. long; style and branches 1-2 mm. long, the style glabrous, deltoid-subulate, compressed, the branches 0.5 mm. long, ascending; ovary glabrous or sometimes with a few scattered hairs near the top, 1 mm. long, ovules 4-10; hypogynous disk prominent about uniformly wide all around and not conspicuously lobed; capsule 4-5 mm. long, ovate to elliptic, glabrous or nearly so, somewhat rounded above, prominently apiculate, valves coriaceous with conspicuous thickened margins, longitudinally sulcate; seeds 1.5-2 mm. long, oblong or ovate, prominently corrugated, corrugations rounded, reticulate, about 10 or 11.

Phacelia glaberrima is a remarkable and localized endemic in the saline desert of north-central Nevada and, until it was rediscovered in the Reese River Valley in June, 1944, by H. D. Ripley and R. C. Barneby, it was known only from the collections of Sereno Watson made in 1868 on King's Expedition. The three presently known collections are: Humboldt Sink, 4300 ft., *Watson in May, 1868* (G, UC frag.); Reese Valley, 5000 ft., *Watson in July, 1868* (G, UC frag.); Reese River Valley 32 miles north of Austin, Lander Co., *Ripley and Barneby No. 6186* (CAS, G, US). Concerning the highly

specialized habitat of *P. glaberrima*, Mr. Barneby writes as follows: "The Reese River Valley is not very exciting for the most part, one of those broad sterile valleys covered with sagebrush and with long fans of gravel leading into the hills, but at one point about 60 miles south of Battle Mountain the mountains close in and the river has to negotiate a short canyon. Here the mountains are mostly volcanic, but there are localized occurrences of limestone, and these have been broken down by weathering into white bluffs of a stiff gravel and clay mixture impregnated with alkali. On the sides of these bluffs, on which nothing else can exist, *Phacelia glaberrima* is abundant, its yellowish herbage very succulent and fragile and its abundant racemes of golden-yellow visible from afar. Occasionally it seeds down into the washes and there was one spot where it was associated with *P. scopulina* and *P. gymnoclada*, the three species, so similar and yet so different, sometimes enlaced into small "trispecific" mats. The corolla of *P. glaberrima* is very open-campanulate, almost rotate when fully expanded, and the leaves are occasionally crenate."

Although *P. glaberrima* might be related to *P. scopulina* because of its smaller corollas which are devoid of corolla-scales, this rare Nevada plant is probably much nearer *P. lutea* and, in its subrotate corollas, it is reminiscent of the equally highly differentiated *P. inundata*, a species which I have also related to *P. lutea*. Among the numerous and varied *Miltitzia* collections of Ripley and Barneby are remarkable glabrous forms of both *P. lutea* and *P. scopulina* but from these *P. glaberrima* may be readily distinguished by the rotately spreading and deeply lobed corolla, the glabrous style, and the thick-rimmed valves of the capsule. From Watson's collections I concluded that the ovary was glabrous as originally described but in the ample material of Ripley and Barneby it is apparent that the ovary is sometimes sparsely and minutely hairy near the top.

Phacelia glaberrima has been reported from the Flax River (Little Colorado River) in northern Arizona, where it was supposed to have been collected by Newberry, but I have located no Arizona collection (cf. Kearney and Peebles, 1942, p. 737).

5. *Phacelia scopulina* (A. Nels.) J. T. Howell

Leaf. West. Bot. 4:16 (1944)

Emmenanthe scopulina A. Nels., Bull. Torr. Bot. Club 25:380 (1898).

Miltitzia lutea (H. and A.) A. DC. var. *scopulina* (A. Nels.) Brand, Das Pflanzenr. IV. 251:131 (1913).

Miltitzia scopulina (A. Nels.) Rydb., Bull. Torr. Bot. Club 40:479 (1913).

Emmenanthe dispar M. E. Jones ex Rydberg, Fl. Rky. Mts. and Adj. Plains 708 (1917), as synonym of *Miltitzia salina*.

Stems several from the top of an annual taproot, 2–10 cm. long, spreading or ascending and tending to be erect, sparsely to rather densely hirsutulous, more or less cinereous, eglandulose or minutely viscidulous above; leaves oblanceolate to oblong or oblong-obovate, 1–3 cm. long, 0.5–1.5 cm. wide, entire, serrate- or crenate-lobed, or rather deeply pinnately lobed, the lobes

oblong, deltoid, or elliptic, the blade obtuse at apex, cuneate to rounded at base, hirsutulous, petioles to 4 cm. long, frequently longer than the blades; racemes rather few-flowered and more or less concealed by the leaves, to 4.5 cm. long, pedicels 1–6 mm. long, erect or sigmoid-spreading, or the lowest recurved in fruit; flowers 5-merous; calyx-segments 2.5–4.5 mm. long, about 0.5 mm. wide, linear-oblong, in fruit becoming 6–7 mm. long, 0.5–1 mm. wide, linear-oblong or linear-oblongate, obtuse, usually without a prominent raised midvein except at the base, hirsutulous, rarely capitate-glandular and perhaps sometimes a little viscidulous; corolla tubular-campanulate, somewhat accrescent in age, 3–5 mm. long, the lobes 0.75–1 mm. long, yellow or strongly tinged with lavender or violet, the outside hairy, the inside glabrous; corolla-scales inconspicuous or obsolete, filiform-linear, about 1 mm. long, free from the base of the filaments; stamens 2.5–3 mm. long, the longest frequently equaling the lobes of the corolla, filaments glabrous, anthers 0.3–0.4 mm. long; style and branches 1.3–2 mm. long, the branches 0.2–0.3 mm. long, the style hirsutulous-hairy to the middle or above; ovary 1–1.25 mm. long, ovules 11–15; hypogynous disk inconspicuous and scarcely lobed between the stamens; capsule 5–6 mm. long, oblong, obtuse or subacute at top below the prominent apiculation, hirsutulous-puberulent especially above; seeds oblong or oblong-ovate, 1.25–1.75 mm. long, brown, prominently corrugated, corrugations rounded, 9–11, reticulate.

Loose sandy or gravelly soil of desert flats and slopes, from southwestern Montana and Wyoming southward to western Utah and northern Nevada, and westward to eastern Oregon.

Representative collections. MONTANA: Melrose, Silver Bow Co., *Rydberg No. 2771* (NY, US).

WYOMING: Green River, Sweetwater Co., *A. Nelson No. 3056* (RM, type of *Emmenanthe scopulina*; G, M, US), *A. Nelson No. 4712* (CAS, G, M, NY, P, RM, US, WS), *M. E. Jones in 1896* (CAS, IU, M, NY, P, RM, US); between Eden and Big Piney, Sublette Co., *Payson and Payson No. 2576* (CM, G, M, NY, P, RM, UC, US).

UTAH: Dutch Mt., Tooele Co., *M. E. Jones in 1891* (P).

NEVADA: Wells, Elko Co., *M. E. Jones in 1930* (P), *Eastwood & Howell No. 330* (CAS, CM, DS, ND, US), *Ripley and Barneby No. 5524* (CAS); 25 miles north of Wells, Elko Co., *Holmgren No. 955* (CAS, IU, UC); foothills of Independence Mts. southeast of Tuscarora, Elko Co., *Ripley and Barneby No. 5551* (CAS); near Wendover, Elko Co., *M. E. Jones in 1929* (CAS, P); Cobre, Elko Co., *M. E. Jones in 1906* (CAS, P), *in 1907* (P); foothills of Schell Creek Range west of Connors Pass, White Pine Co., *Ripley and Barneby No. 6305* (CAS); Monitor Valley south of Lone Mt., Eureka Co., *Ripley and Barneby No. 6203* (CAS); 11 miles west of Eureka, Eureka Co., *Ripley and Barneby No. 6235* (CAS); Reese River Valley 32 miles north of Austin, Lander Co., *Ripley and Barneby No. 6187* (CAS).

OREGON: Harney Lake, Harney Co., *Henderson No. 8688* (CAS); 24 miles

north of Wagontire, Harney Co., *Peck No. 19394* (W, simulating atypical *P. lutea*); 8 miles west of Lakeview, Lake Co., *Peck No. 15243* (W, more glandular than typical); south of Narrows, Harney Co., *Ripley and Barneby No. 6088* (depauperate, CAS).

Although Brand considered *Emmenanthe scopulina* a variety of *Miltitzia lutea*, I can see no reason for following so conservative a procedure. *Phacelia scopulina* has a very distinctive appearance and is marked by excellent characters over a wide range; and, in a much more restricted range, *Phacelia lutea* is usually quite as distinct. In eastern Oregon, however, where the ranges of the two species overlap, plants have been collected which are confusingly intermediate in appearance, although from the critical characters of the flower-parts, such specimens have been definitely referable to one species or the other. A pair of such specimens has been collected by Prof. M. E. Peck, *P. lutea* coming from 7 miles east of Buchanan, Harney County (*No. 20536*, W), *P. scopulina* from 25 miles north of McDermitts, Malheur County (*No. 20600*, W). A series of collections of *P. lutea* accompanied by field notes made by Cusick in eastern Oregon and preserved in the Gray Herbarium would seem to indicate that some of the variations noted may be due to environmental conditions, but it seems likely that much of the variability results from the genetic makeup of the group and may be due to hybridization between *P. lutea* and *P. scopulina*. Cusick's collections are more fully described under *P. lutea*.

Another collection of *P. scopulina* that exhibits noteworthy variability was made by Ripley and Barneby in Humboldt County, Nevada (*No. 4557*, CAS). In this collection there are two kinds of plants, one that is normally hirsutulous-pubescent throughout, the other that is quite glabrous except for a few scattered hirsutulous hairs on some of the leaves and for a few minute capitate-glands on the stems, calyx-segments, and upper part of the ovary. Because the only known collections of *P. glaberrima* were made in the northwestern part of Nevada not very far from the station where Ripley and Barneby found this odd variant, their plants were compared with specimens of *P. glaberrima*. The floral morphology of the two was found to be so unlike that it would be quite wrong even to suggest that the subglabrous individuals are intermediate between the two species.

M. E. Jones distributed his 1896 collection of *P. scopulina* made at Green River with the name *Emmenanthe dispar*, but apparently he never described the plant. Although Rydberg published the name as a synonym of *Miltitzia salina*, as indicated above in the synonymy, he had correctly determined and annotated Jones' specimen in Herb. N.Y. Bot. Gard. as *Miltitzia scopulina*.

6. *Phacelia submutica* J. T. Howell, spec. nov.

Herba annua plus minusve glanduloso-hirsutula; caulibus paucis vel multis ex basi, patentibus vel suberectis, 2-8 cm. longis, purpurascenti-tinctis, sparse vel subdense vestitis pilis et hirsutulis albis gracilibus et paucis capitate-glandulosis; foliis plerumque dispersis, 0.5-1.5 cm. longis, 0.2-0.8 cm. latis,

elliptico-oblongis ovatis obovatisve, integris vel tenuiter crenulatis vel prominenter serrato-lobatis, apice obtusis, cuneatis basi, plus minusve hirsutululis, petiolo ad 2 cm. longo, sæpe quam lamina longiore; racemis circa 2 cm. longis, sæpe foliis brevioribus, floribus subeongestis vel infimis distantibus, pedicellis plerumque erectis vel adscendentibus, ad 6 mm. longis; floribus 5-meris; segmentis calycis ad anthesin 3.5–5 mm. longis, 0.3–0.5 mm. latis, in fructu valde accrescentibus, 6–10 mm. longis, 0.3–1 mm. latis, hirsutululis et capitato-glandulosis, basi calcariformi-angulata, costa prominenti; corolla tubulata, 3.5–4.5 mm. longa, dilute lutea, haud purpureo-tincta, pubescenti extus, intus glabra. lobis 1 mm. longis, crenulatis; squamis ad lineas reductis vel nullis; staminibus inclusis, 2.2–2.75 mm. longis, filamentis glabris, antheris 0.3 mm. longis, latioribus quam longioribus explanatis; stylo et ramis 1.25–1.5 mm. longis, stylo paulum pilifero tantum prope basin, ramis 0.2–0.25 mm. longis; ovario 0.75–1 mm. longo, hirsutulo supra, ovulis 10 vel 11; capsula 3–5 mm. longa, elliptica vel elliptico-ovata, apice rotundata, mutica vel brevissime apiculata, longitudinaliter dorso valvarum sulcata, sparse hirsutula superne; seminibus 1.5–2 mm. longis, subovatis vel ovato-oblongis, obtusis, nigro-brunneis, paulo angulatis, prominenter transverse corrugatis, rugis circa 12, profunde alveolato-reticulatis.

Type: No. 163032 in Rocky Mountain Herbarium, University of Wyoming, collected on May 19, 1911, at **DeBeque, Mesa County, Colorado**, by George E. Osterhout, *No. 4458*. There is a duplicate in Herb. N.Y. Bot. Gard. *Phacelia submutica* is known only from Osterhout's collections made at DeBeque, others being: *No. 4726* (RM, frag. CAS) and *No. 5978* (RM, frag. CAS).

Although *P. submutica* is obviously related to *P. scopulina* from which it was undoubtedly derived, it may be readily differentiated by a number of distinctive characters that indicate, each in a small way, a separate specific entity. *Phacelia submutica* has a rather distinctive appearance which comes from its less leafy and more floriferous habit and which is also due to the less cinereous character of the pubescence. In *P. submutica* the fruiting calyx-segments are usually much more elongate; and while the pedicels of the lower flowers are reflexed or sigmoid-spreading in fruit in *P. scopulina*, they are mostly strictly erect or ascending in *P. submutica*. There is a noteworthy difference in the coloration of the corolla in the two species, too, that of *P. submutica* being yellowish, that of *P. scopulina* being more or less strongly tinged in age with lavender or violet. The stamens in *P. scopulina* equal or exceed the corolla-throat, sometimes in anthesis even exceeding the corolla-lobes, while in *P. submutica* the stamens are shorter than the corolla-throat. Although all these characters indicate real differences between *P. submutica* and *P. scopulina*, they are not so important either specifically or diagnostically as the characters that are found in the style, capsule, and seed. In *P. submutica* the style is glabrous except for a few hairs near the base, but in *P. scopulina* the style is hirsutulous-hairy to the middle or above, generally densely so. The capsule of *P. submutica* differs from the capsules of other species in this

section except *P. tetramera*, in that it is either entirely devoid of a terminal apiculation or has a very insignificant one. By contrast, the capsule of *P. scopulina* is prominently apiculate. The differences in the seeds, although small, are nevertheless appreciable: the seeds of *P. submutica* are usually larger and more finely and numerousy corrugated, the corrugations are not so rounded and are more deeply alveolate-pitted, and the seed-cover is blackish-brown and tends to be iridescent.

Hence, although *P. submutica* is undoubtedly closely related to *P. scopulina*, I believe that it is an entity sufficiently distinguished to be accorded specific recognition.

7. *Phacelia inyoensis* (Macbr.) J. T. Howell

Leafl. West. Bot. 4:16 (1944)

Mitiltzia inyoensis Macbr., Contrib. Gray Herb., n. ser., 49:41 (1917).

Stems erect or spreading, slender, one to several from the top of the taproot, 2–10 cm. tall, hirsutulous and finely capitate-glandular; leaves few and scattered, not concealing the flowers, 0.5–1.5 cm. long, 0.3–1 cm. wide, oblong to elliptic or obovate, entire to coarsely and pinnately few-lobed, subobtuse at apex, cuneate at base, hirsutulous and more or less finely capitate-glandular, petioles of basal leaves to 2 cm. long, those of the uppermost leaves only about 3 mm. long; racemes lax, loosely few-flowered, to 7 cm. long, the lowest flowers distant, the uppermost approximate, pedicels slender and spreading, 2–6 mm. long, hirsutulous and glandular; flowers 5-merous; calyx-segments in flower a little unequal, 2–3 mm. long, 0.4–0.75 mm. wide, linear to linear-oblaneeolate, in fruit 3.75–6 mm. long, 0.5–1.3 mm. wide, linear-oblong to oblaneeolate, somewhat spatulate, narrowed below to claw-like base, subacute, glandular and hirsutulous; corolla pale yellow becoming tinged with violet, tubular- or cylindric-campanulate, 3–3.5 mm. long, lobes erect, 0.6–1 mm. long, corolla-tube hairy outside to the base, glabrous inside; corolla-scales obsolete or present as a mere line about 1 mm. long, free from the base of the filaments; stamens 1.5–2.5 mm. long, filaments glabrous, anthers about 0.2 mm. long, wider than long after dehiscence; style and branches 1 mm. long, branches 0.2–0.25 mm. long, style glabrous except at the very base; ovary 1 mm. long, hairy above, ovules 18–20; hypogynous disk relatively prominent with roundish lobes between the stamens; capsule 3.3–4 mm. long, elliptic, rounded-obtuse, shortly apiculate, sparsely hirsutulous, valves shallowly longitudinally sulcate on the back; seeds nearly 1 mm. long, ovate or deltoid-ovate, acute at apex, rounded at base, brownish, corrugations rather prominent, reticulate, 6 or 7.

Known only from Owens Valley, Inyo County, California.

Collections. Foothills west of Bishop, *Heller No. 8324* (G, type; CAS, DS, US); Big Pine, *K. Brandegee in 1913* (P); Lone Pine, *K. Brandegee in 1913* (CAS, P).

According to data accompanying Heller's collection, the habitat in which

this rare species grows is "a small dry peat bog among the granite sands." Although it is quite a distinct species, it is probably most closely related to *P. salina* and through it to *P. scopulina*.

8. *Phacelia salina* (A. Nels.) J. T. Howell

Leaf. West. Bot. 4:16 (1944)

Emmenanthe foliosa M. E. Jones, Zoe 4:278 (1893).

Emmenanthe salina A. Nels., Bull. Torr. Bot. Club 25:381 (1898).

Milititzia foliosa (M. E. Jones) Brand, Das Pflanzenr. IV. 251:131 (1913).

Milititzia salina (M. E. Jones) Rydb., Bull. Torr. Bot. Club 40:479 (1913).

Not *Phacelia foliosa* Phil., Anal. Mus. Nac. Chile 53 (1891).

Not *Phacelia salina* M. E. Jones ex Brand, Das Pflanzenr. IV. 251:119 (1913), as synonym.

Stems short and stout or slender and spreading, 2 to several from the top of a slender annual taproot, 0.5–3 cm. or even to 6 cm. long, sparsely hirsutulous, eglandulose or minutely and sparsely capitate-glandular above and in the inflorescence; leaves entire, sinuate-wavy, serrate or pinnately few-lobed, 0.5–1.5 cm. long, 0.3–0.9 cm. wide, oblanceolate to elliptical or obovate, sparsely hirsutulous, obtuse, narrowly to broadly cuneate at base, frequently a little asymmetrical at base, petioles 0.5–3 cm. long; racemes exceeded by the leaves, laxly few-flowered and only slightly scorpioid, the flowers distant or tending to be congested near the ground at the base of the stems, pedicels 1–5 mm. long, straight or spreading; flowers 5-merous; calyx-segments in flower 2.5–4 mm. long, in fruit 4.5–6 mm. long, 0.5–0.75 mm. wide, linear to linear-oblong or linear-oblanceolate, sparsely hirsutulous and sometimes a little glandular; corolla yellow or tinged with lavender, tubular, 3–4 mm. long, the lobes erect, 0.9–1.25 mm. long, the corolla hairy outside, glabrous within; corolla-scales generally lacking, if present filiform and about 1.5 mm. long, at base free from the filaments; stamens 1.5–2.5 mm. long, filaments glabrous, anthers about 0.25 mm. long, roundish; style and branches 1 mm. long, the branches 0.2–0.25 mm. long, style hairy only near the base or to near the middle; ovary 0.75–1 mm. long, ovules 7–9; hypogynous disk with relatively prominent rounded-deltoid lobes, the lobes alternating with the stamens and about 0.2 mm. long; capsule 3–4 mm. long, broadly elliptical or elliptic-ovate, obtuse and apiculate, sparsely hairy, the valves thin-chartaceous with thick conspicuous margins, back of the valves shallowly sulcate; seeds brown, 1.5–2 mm. long, acute or subacute at both ends, oblongish to ovate, prominently corrugated, corrugations 9–11, broad and rounded.

Of rare and local occurrence in alkaline soil in southern Wyoming, western Utah, and northern Nevada.

Collections. Bitter Creek, Sweetwater Co., Wyoming, *A. Nelson No. 3105* (RM, type of *Emmenanthe salina*; CAS, G, M, US), *A. Nelson No. 4786* (NY); Deep Creek Valley above Furber, Tooele Co., Utah, *M. E. Jones in 1891* (P, type of *Emmenanthe foliosa*; CAS, DS, G, M, UC, US); in loose red sand, west end of White Pine Mts. below Little Antelope Summit, White Pine Co., Nevada, *Ripley and Barneby No. 3592* (CAS); Reese River Valley 6

miles northwest of Austin, Lander Co., *Ripley and Barneby No. 5926* (CAS); east base of Railroad Pass, Lander Co., *Ripley and Barneby No. 5932* (CAS).

There is considerable variation in the data accompanying the original collection of *Emmenanthe foliosa*. The specimen in the Jones Herbarium at Pomona College which I am accepting as the type gives "Furber, Nevada," June 8, 1891, while a second sheet gives "Deep Creek, alkaline flats above Furber, Nevada." Data on specimens in Herb. Calif. Acad. Sci. and U.S. Nat. Herb. are "On Deep Creek, above Furber," Utah, June 8, 1891; and in Gray Herbarium in Jones' handwriting are "Deep Creek, Utah," June 4, 1891. The data given in the original description are still different: "Deep Creek, Utah, June 6, 1891, altitude 5000 feet." After a careful study of the plants constituting these specimens, I have concluded that all are parts of one collection; and by reference to the "Botanical Exploration of Marcus E. Jones from 1875 to 1919" (Ms.), I believe the correct data for the collection to be: Alkaline flats, Deep Creek Valley above (i.e. south of) Furber, Tooele Co., Utah, June 8, 1891. According to his journal (i.e., p. 19), Jones was at Fish Springs on June 4, at Ibapah on June 6, and at Furber on June 8.

Phacelia salina is intermediate between *P. scopulina* and *P. tetramera*, the three species apparently representing a distinct phylogenetic line. Morphologically *P. salina* seems more closely related to *P. scopulina*, differing chiefly in the smaller size of most parts; but ecologically it is much nearer *P. tetramera*, both species being usually restricted to highly alkaline or mineralized situations in desert regions. *Phacelia salina*, *P. inyoensis*, *P. glaberrima*, and *P. submutica* are to be counted among the rarest of western plants.

9. *Phacelia tetramera* J. T. Howell

Leaf. West. Bot. 4:16 (1944)

Emmenanthe pusilla A. Gray, Proc. Amer. Acad. 11:87 (1876).

Miltitzia pusilla (A. Gray) Brand, Das Pflanzenz. IV. 251:132 (1913).

Miltitzia pusilla (A. Gray) Brand var. *flagellaris* Brand, l.c.

Not *Phacelia pusilla* Buekl., Amer. Jour. Sci. 45:172 (1843); nor *P. pusilla* Torr. ex S. Wats., Bot. U.S. Geol. Explor. 40th Paral. (King's Exped.) 253 (1871).

Stems several from the top of the taproot, spreading or ascending, 2-10 cm. long, slender, finely glandular-villous and near the base sparsely hirsutulous; leaves narrowly elliptic-oblong to oblong-oblongeolate, 0.4-1.5 cm. long, 0.2-0.7 cm. wide, entire or saliently few-serrate-lobed, obtuse, narrowly cuneate at base, sparsely hirsutulous, petiole 0.4-1.5 cm. long, glandular-villous; racemes to 8 cm. long, very laxly flowered, the lowest flowers distant, pedicels to 4 mm. long, slender, recurved or spreading in the lower flowers; flowers usually 4-merous, sometimes 5-merous; calyx-segments in flower 2.5 mm. long, oblong or narrowly oblong-ovate, in fruit unequal in width, 4-5 mm. long, 0.5-1 mm. wide, narrowly to broadly oblong, hirsutulous and sparsely and minutely glandular, obtuse, united at base sometimes as much as 2 mm., the base cuneate; corolla whitish, 1.3-1.8 mm. long, campanulate, the lobes erect, 0.5-1 mm. long, the lobes sparsely hairy outside, glabrous inside; corolla-scales

none; stamens 1 mm. long, filaments glabrous, anthers roundish, nearly 0.2 mm. across; style 0.25–0.4 mm. long, the branches indicated only by an emargination at the top of the style; ovary roundish, 0.75 mm. long, hirsutulous at top, ovules 20; hypogynous disk narrow and inconspicuous; capsule oblong to oblong-obovate, 3–4 mm. long, very obtuse, shortly apiculate or mucous, sparsely hirsutulous, the very base sometimes a little inferior; seeds 1 mm. long, narrowly ovate to quadrate, round at base, acute at apex, light brown, finely and sometimes indistinctly corrugated, corrugations about 7–9.

Alkaline flats and washes of high valleys, eastern Oregon south to central Nevada and eastern California.

Representative collections. OREGON: Union Co., *Cusick No. 758* (CM, G, US); first-cited collection of *Miltitzia pusilla* var. *flagellaris*; Malheur River, Harney or Malheur Co., *Cusick No. 1946* (CM, G, M, ND, RM, UC, US, WS); Wagontire, Harney Co., *Peck No. 20844* (W); 8 miles west of Lakeview, Lake Co., *Peck No. 15243* (CAS, NY, W).

NEVADA: 8 miles north of Twin Bridges, Elko Co., *Holmgren No. 871* (IU, UC); Steamboat Springs, Washoe Co., *S. Watson* (G, type of *Emmenanthe pusilla*; NY); Washoe Lake, Washoe Co., *M. E. Jones in 1897* (CAS, CM, DS, P, US); Empire City, Ormsby Co., *M. E. Jones No. 3987* (CAS, DS, IU, M, NY, P, RM, UC, US); foothills of Toiyama Range near Belmont, Nye Co., *Ripley and Barneby No. 3696* (CAS); northwestern Nevada, *Lemmon in 1875* (G); Grass Valley, Lander Co., *Ripley and Barneby No. 5920* (CAS).

CALIFORNIA: "Sierra Nevada Mts.," *Lemmon in 1875* (US); Chat, Plumas Co., *M. E. Jones in 1897* (CAS, P); Long Valley, Mono Co., *J. T. Howell No. 14382* (CAS, CM, G, IU, P, US); valley east of Cedarville, Modoc Co., *Ripley and Barneby No. 6005* (CAS).

The earliest collection of this species, *Watson No. 878* from Steamboat Springs, was included by Torrey in his *Phacelia pusilla*; and, although Gray cited Watson's collection in his original description of *Emmenanthe pusilla*, Brand annotated it in the U.S. National Herbarium as *Phacelia pusilla* Torr. and cited it as that species in his monograph (1913, p. 122).

The most remarkable feature of *P. tetramera* is the tendency for the flowers to be 4-merous instead of 5-merous as is usual in *Phacelia*. The reduction in the number of parts seems to result from the suppression of one part of the calyx, corolla, and androecium, and not to be due to the union of adjacent parts. Although most of the flowers that have been examined are truly 4-merous, occasionally they are either partly or completely 5-merous. In some 5-merous flowers, the fifth calyx-segment is much smaller than are the other four; in one case two calyx-segments were united nearly throughout, while the other three were deeply divided. It has been noted that 5-merous flowers are more numerous in specimens from Oregon than in those from California or Nevada. Certainly the reduction of flower-parts exhibited by *P. tetramera* is a most unusual tendency in *Hydrophyllaceae*.

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